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ABSTRACT

This guide, which is one in the "Exploration" series of curriculum guides intended to assist junior high and middle school industrial educators in helping their students explore diverse industrial situations and technologies used in industry, deals with servicing products. Lessons on servicing products and evaluating those in need of repair are provided. Topics covered in the lessons include the basic types of service; reasons for growth in the number of service occupations; elements of industrial service; industrial service processes; basic types of industrial organizations; the attributes of a service organization; and diagnosing, repairing, testing, and completing a work order on a defective product. The guide includes the rationale behind its development, hints to the teacher, lesson plans, student handout masters, teacher aids, a unit examination, and a list of references. The lesson plans include cross-referenced lists of objectives, lesson content, and learning activities. (MN)

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The Illinois
Plan for Industrial
Education

Illinois
State Board of
Education

Adult,
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SERVICING PRODUCTS

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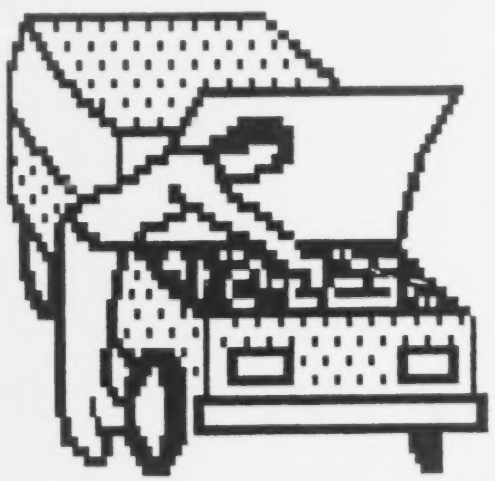
PACKET INCLUDES:

- Rationale
- Hints to the Teacher
- Lesson Plans
- Student Handout Masters
- Teacher Aides
- Unit Examination
- References



ILLINOIS PLAN FOR INDUSTRIAL EDUCATION

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NOTE: The content for this unit was taken with permission from research done by Dr. Terry James Squier. His thesis, "The Development and Evaluation of an Industrial Service Unit of Study for Junior High School Industrial Education," was completed in June, 1982.

INTRODUCTION

"Servicing Products" is one of a series of curriculum materials developed for junior high and middle school industrial educators. Listed below are the titles of the units in the series.

Communication
- Using the Language of Industry
- Exploring Computer Technology
- Exploring Photography
- Exploring Graphic Communication
- Exploring Electronic Communication

Energy Utilization
- Exploring Solar Energy
- Using Alternate Energy Sources
- Conserving Energy Sources
- Exploring Electricity/Electronics
- Exploring Mechanical and Fluid Systems

Impact of Industry and Technology
- Recycling Materials
- Limiting Pollution
- Exploring Careers in Industry and Technology
- Exploring Technology and the Future

Production
- Exploring Materials and Processes
- Exploring Construction Technology
- Research and Development
- Exploring Manufactured Systems
- Servicing Products

Transportation
- Exploring Land Transportation Systems
- Exploring Aviation Technology
- Exploring Water Transportation Systems
- Exploring Space Transportation Systems
- Exploring Materials Handling Systems

With the Exploration Series, industrial educators can lead their 7th and 8th grade students in exploring many industrial situations and technologies used in industry. In addition, this series can serve as a resource for teachers orienting 9th and 10th grade students to industrial technologies in communication, production, energy utilization and transportation. Each unit in the series includes a rationale, hints to the teacher, lesson plans, student handouts, teacher aids, a unit examination, and a list of references.

"Servicing Products" and other units in the series are available on a cost recovery basis through the Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

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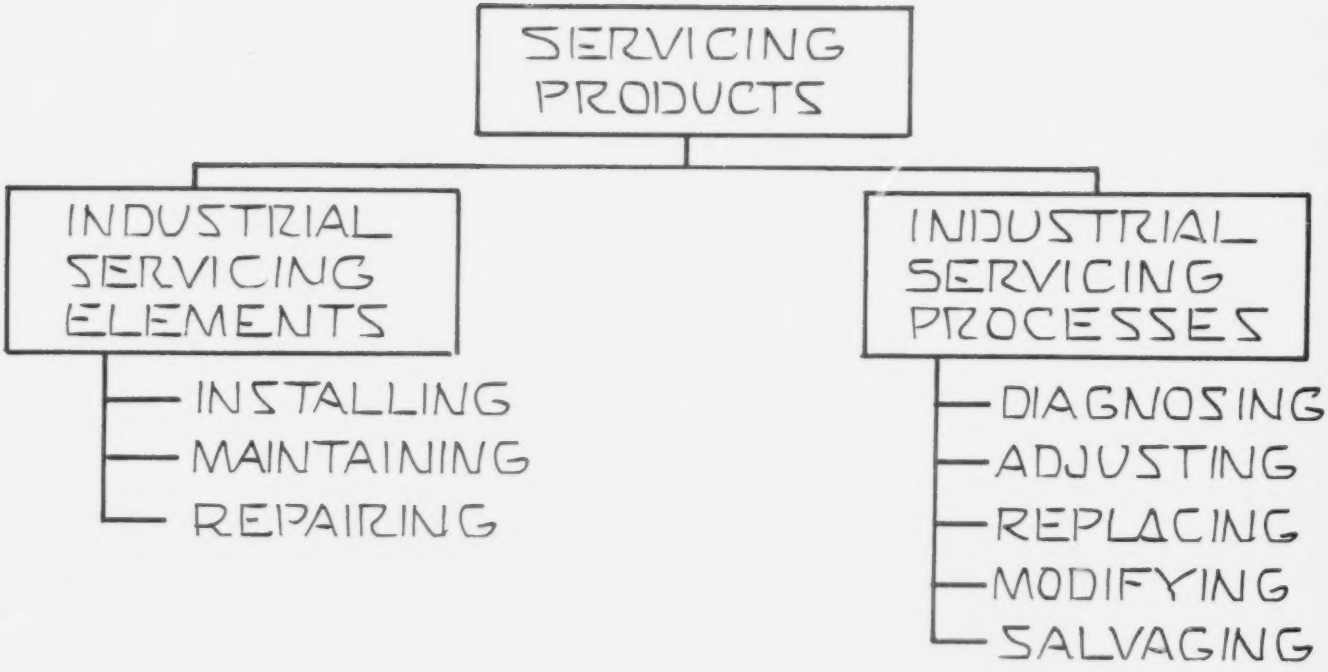
SERVICING PRODUCTS
Rationale

Service is a dominant part of present day society and is projected to continue to increase in importance. This trend is due to: (1) an increase in income, (2) an increase in the standard of living, (3) the shortage of raw materials and energy, (4) the labor intensive nature of the service, and (5) the projected demand by consumers for better servicing of purchased goods. Since service is an essential part of today's industrial technological society, expanding present industrial education curriculua to include the study of industrial service which includes installation, maintenance, and repair of goods is logical and desirable. This study should include a focus upon the resources, technical processes, application, and technological impact unique to industrial service while acknowledging the interrelationship between goods producing and goods servicing. The field of Industrial Education can no longer be content to focus upon the goods producing industries and activities and neglect the dominant economic sector of society -- the service sector.


SERVICING PRODUCTS
INDUSTRIAL SERVICING ELEMENTS
INSTALLING
MAINTAINING
REPAIRING
INDUSTRIAL SERVICING PROCESSES
DIAGNOSING
ADJUSTING
REPLACING
MODIFYING
SALVAGING

SERVICING PRODUCTS

HINTS TO THE TEACHER

1. The purpose of this unit is to introduce students to the concept of industrial service. This unit features two learning activities. Prior to implementing this lesson, you will need to review and select a learning activity for this unit. If time permits, consider implementing both learning activities.

2. One of the learning activities in this unit centers around diagnosing and repairing teacher-made products. The product suggested is a simple circuit containing batteries, light bulb, switch, and a series of conductors. A product of this kind can be easily bugged by the teacher and serviced by the students. In addition to being inexpensive, students need very little background knowledge prior to engaging in the servicing activity.

3. The second learning activity in this unit centers around diagnosing and repairing small engines. This learning activity provides students with a servicing experience that can be easily transferred to the real world. Their experiences with lawn mowers, snowmobiles, minibikes, go carts, and ATV's make them keenly interested in the internal workings of a small engine. Given the fact that small engines can be easily bugged and that students are eager to tinker, the engines provide an excellent medium for teaching servicing concepts.

3. The concepts taught in this unit can be integrated into almost any other unit. For example, during the Electronic Communication unit, students can be asked to service a simple phone system. During the Material Handling unit, students could be asked to service an industrial robot. Lastly, during the Land Transportation unit, students could diagnose and repair bicycles. These are but a few examples. The options for integrating servicing concepts into the curriculum are almost limitless.

4. Consider inviting a guest speaker to talk to your class about what it is like to work in a service occupation. A few good sources for guest speakers include your local phone company, a business machine company, a copy machine company, or an automobile service centers. Ask the guest speaker to describe a typical day in their service business. For instance, service people spend so much time dealing directly with the public, they often have many funny stories.

5. Consider inviting a school administrator to visit your class while the students are engaged in servicing activities. Ask your students to prepare a defective product for the administrator to diagnose and repair. Ask your students to explain the servicing process and how to use the test equipment.

Unit: Servicing Products

Lesson 1: Servicing Products

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to -identify a definition for service. -differentiate between industrial and personal service. -identify definitions for personal and industrial service. -identify the percentage of workers employed in service jobs. -identify the four reasons why industrial service will continue to be an important element in our economy. -identify examples of installing, maintaining, and repairing. -list the three basic elements that comprise industrial service. -list the five basic industrial servicing processes. -identify the two basic types of industrial organizations. -identify the five basic attributes of a service organization.	A. Servicing 1. Introduction to service a. doing work for the benefit of others is called service. b. 68% of all workers are employed in service jobs. 2. Basic types of service a. industrial service; work that maintains or improves goods b. personal; work that maintains or improves the well being of people. 3. Reasons for growth in the number of service occupations. a. higher incomes and increased standard of living b. shortage of raw materials and energy c. people own more goods requiring service d. service activities are difficult to automate 4. Elements of industrial service a. install b. maintain c. repair	A. Teacher Guided Discussion 1. Ask students to list examples of people who provide a service to earn a living. 2. Using OT #1-1, introduce students to the concept of service. 3. Using OT #1-2, discuss the two basic types of service. Provide examples of each type. 4. Using OT #1-3, discuss the reasons for growth in the number of service occupations. 5. Using OT #1-4, discuss the three basic elements that constitute industrial service. Provide examples for each element. 6. Using OT #1-5, discuss the five basic industrial servicing processes. Provide examples for each process.	

5. Industrial service processes
   a. diagnose
   b. adjust
   c. replace
   d. modify
   e. salvage
6. Basic types of industrial organizations
   a. service companies
   b. goods producing companies
7. Attributes of a service organization
   a. service work is done close to the customer
   b. service workers do not produce a product
   c. service cannot be stored for future use
   d. the customer often pays for mostly labor
   e. most service companies are small

7. Using OT #1-6, discuss the two basic types of industrial organizations. Provide examples for each type of organization.
8. Using OT #1-7, describe the attributes of a service organization.

B. Following a demonstration in a lab activity, students will be able to:
-use simple test equipment to diagnose a defective product.
-repair a defective product by identifying, removing, and replacing defective parts.
-test the repaired product.
-complete a work order documenting the service rendered.

B. Servicing a defective product
1. Diagnosing
   a. testing the batteries
   b. testing the light bulb
   c. testing the switch
   d. testing the conductor path

-or-

   a. testing the ignition system
   b. testing the compression system
   c. testing the fuel/air system
2. Repairing
   a. identifying the defective part
   b. removing the defective part
   c. replacing the defective part
3. Testing
4. Completing a work order
   a. documenting the work performed
   b. documenting labor
   c. documenting parts
   d. documenting costs

B. Learning Activities
1. Introduce students to the product, tools and equipment, and the job ticket used during this learning activity.
2. Demonstrate how to use the tools and equipment to diagnose a defective product.
3. Demonstrate how to complete the work order.
4. Provide each student HO #1-1 and HO #1-2 or 3
5. Divide your class into teams of two students and assign each team a work station.
6. Have each team service their defective product.
7. Circulate around the room and provide individual instruction as needed.
8. When students have finished the lab activity, review the servicing concepts explored.
9. Collect and evaluate the repaired products and the work orders.

SERVICING PRODUCTS

Preparation Hints:

1. Review the materials provided, duplicate HO #1-1, and prepare the transparencies needed to present this lesson.

2. This unit features two learning activity options. The first is to have your students to diagnose and repair a defective electrical circuit. Your second option is to have students diagnose and repair small gasoline engines. Your preparation needs will depend upon the learning activity you select.

   Servicing Electrical Circuits:

   During the lab activity, your students will be using simple test equipment to service a defective product. Prior to implementing this lesson, you will need to set up work stations. Each station will need a test panel featuring a volt meter, light bulb tester, and a continuity tester. Refer to the plans in Figure 1-1 when making your test panels.

   During the lab activity, your students will be servicing defective products. Prior to implementing this lesson, you will need to collect defective components and make products that can be easily bugged. Your collection of defective parts needs to include bulbs, switches, batteries, and wire leads. Use the plans provided in Figure 1-2 when making servicable products.

   Prior to implementing this lesson, you will need to use the defective parts you have collected to bug your products. Install either a bad battery, bulb, wire lead, or switch in each product. Create a parts department by putting the good batteries, bulbs, wire leads, and switches in a central location in your laboratory.

Servicing Small Engines:

During the lab activity, your students will be using a variety of tools to service their engines. Prior to implementing this lesson, you will need to set up several work stations. Each work station will need a spark plug socket, socket wrench, sockets for the blower housing bolts and the cylinder head bolts, screw drivers, and whatever other tools are needed to service your engine.

During the lab activity, your students will need to service engines that will not start. Prior to implementing this lesson, you will need to collect defective spark plugs and head gaskets. To make a spark plug defective, simply open the gap between the electrodes. To make a head gasket defective, cut a section out with tin snips or flatten a section with a hammer.

Prior to implementing this lesson, you will need to use the defective parts you have collected to bug your engines. Install either a bad spark plug or head gasket into some of your engines. Close the idle and main fuel screws on the balance of your engines. Create a parts department by putting the good spark plugs and gaskets in a central location in your laboratory.

To minimize wear and tear on your engines, consider removing the steel bolts from the blower housing and replacing them with nylon plastic 1/4 inch bolts. This will extend the life of the threads on the cylinder head and the engine block where the blower housing is attached.

Have extra head gaskets available as they are easily damaged during disassembly. Do not use gasket cement. It will make conducting future servicing activities very difficult and time consuming.

Content Presentation Hints:

1. Consider showing your students a film or videotape on servicing or service-related occupations.

2. When discussing the three basic elements that constitute industrial services, provide concrete examples for each element. For example, a discussion on installing could feature air conditioners, burglar alarms, computer systems, and sound systems. A discussion on maintaining could include the following: changing oil in the car, washing windows, painting

buildings, and cleaning the tape head in a cassette player. Repairing could be characterized by repairing a flat tire, replacing broken windows, and replacing a defective transister in an electronic device.

3. Discuss the five basic servicing processes in the context of a common servicing activity. For example, an automobile mechanic has been asked to service an engine that is running rough. The mechanic's first task is to diagnose what is causing the engine to run rough. The next step might be to adjust the engine's carburator. The third step might be to replace the engine's spark plugs. Next, the choke linkage might be modified so it moves more freely. Lastly, the mechanic might salvage the engine's old exhaust system for scrap metal.

4. Write several examples of occupations on the chalk board. Differentiate between those that are goods producing and those that are service-related occupations. Ask students to list additional occupations (perhaps those of parents or relatives) and list these on the board. Ask students to classify each occupation as goods producing, service-related, or both. Ask students to list ten companies in your community that provide a service, as well as produce a product. Identify the name of the company, the product they produce, and the service they provide.

5. Provide students with a story problem that requires them to decide whether to replace or repair a product. For example, tell students their new bicycle has a flat tire. Patching the inner tube will cost $3.50. The patch is fifty cents, labor to remove and replace the tube is $2.00, and the labor to repair the tube is $1.00. Replacing the inner tube will cost $5.00. The new tube costs $3.00 and the labor to remove and replace the tube is $2.00. Should the inner tube be replaced or repaired and why?

Learning Activity Hints:

Servicing Electrical Circuits:

1. After students have diagnosed and repaired their assigned product, consider allowing them to bug their product and pass it on to another team to service. This process could be continued for two or three rounds of servicing activities.

2. When demonstrating how to diagnose a defective product, show students how to use the volt meter to test batteries, use the light socket to test light bulbs, and use the continuity tester to test switches and wire leads.

3. After students have experienced servicing a product with one defective part, consider conducting a second round of servicing activities with products containing more than one defective part.

4. If your students have not studied electricity prior to implementing this unit, you may need to prepare and present a short lesson on the basic elements of an electrical circuit. The lesson should introduce students to the energy transducer, control device, output transducer, and conductor path that constitute the product being serviced. This lesson could be delivered in the context of an employee training session.

Servicing Small Engines:

1. If your students have not studied internal combustion engines prior to implementing this unit, you may need to prepare and present a short lesson on the four stroke engine. This lesson should introduce students to the mechanical, lubrication, cooling, fuel, ignition, and starting systems. Consider using a small engine with the cylinder head removed to show students the four stroke cycle. To help students understand the concept of a cycle, describe it as a sequence of events that repeats itself (i.e., spring, summer, fall, winter, or intake, compression, ignition, exhaust). This lesson could be delivered in the context of an employee training session.

2. When demonstrating how to service a small engine, caution students about electrical shock when testing the ignition system. It may not be dangerous, but it sure hurts! In addition, caution students about metal burrs on the fly wheel and other parts of the engine.

3. Avoid starting engines indoors unless you have a good exhaust ventilation system. Move your engines to a safe location outside when testing serviced engines.

4. Constantly monitor students during this activity to avoid costly repairs. Students easily forget which way to turn a bolt to loosen it. It is not uncommon for students to force fit parts together during engine disassembly and assembly. This can be very expensive.

Consider using the following poetic phrase: "Righty, tighty -- lefty, loosey." Students find this saying easy to remember and fun. Don't be surprised if you hear them reciting it during the servicing activity.

Another strategy is to use nut drivers to tighten bolts. During the approval stage, you could supervise the actual tightening process. Without exception, have students finger tighten the spark plugs before using a wrench of any sort. Lastly, be sure students cross tighten cylinder head bolts in the order recommended by the engine manufacturer.

5. Role play that your students are all service technicians at a local dealership. Their livelihood depends on their being able to service the engines at a fair cost and still make a profit for the company. Tell them that unhappy customers will not come back for future service. Their employer and their job depends upon accurate and efficient diagnosis and repair. Each technician should be encouraged to follow the prescribed servicing procedure, properly complete the work order, and thoroughly test their engine.

6. The learning activity provided requires very little prior knowledge of internal combustion engines. If you need to make the servicing activity more challenging, consider adding more defects to various engine systems. The lab sheet provided can serve as a model for developing a more comprehensive troubleshooting experience. Other planted defects could include water in the gas tank, clogged fuel filters, worn lifters, bad points, defective condensers, enlarged magneto coil gaps, defective needle valves and seats, misaligned timing, and dirty air filters.

7. During your demonstration, stress the systems approach to problem solving and remind students to think about systems and not parts. When students attempt to remove unncessary parts when the spark plug does not work, ask the student why. Discourage the students from taking the shotgun approach (replacing all the parts) to servicing.

FIGURE H1. VOLT METER, BULB TESTER, AND CONTINUITY TESTER

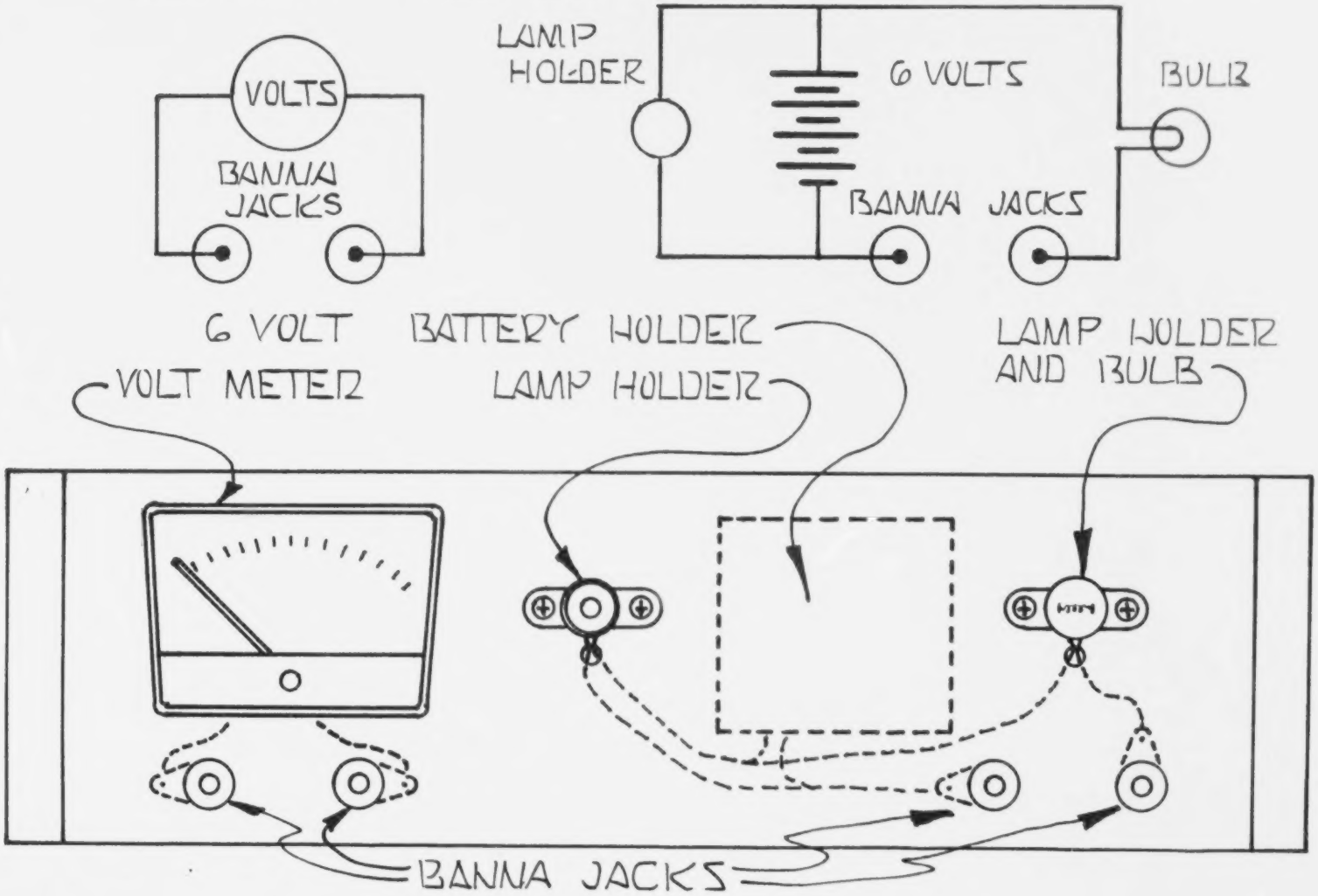
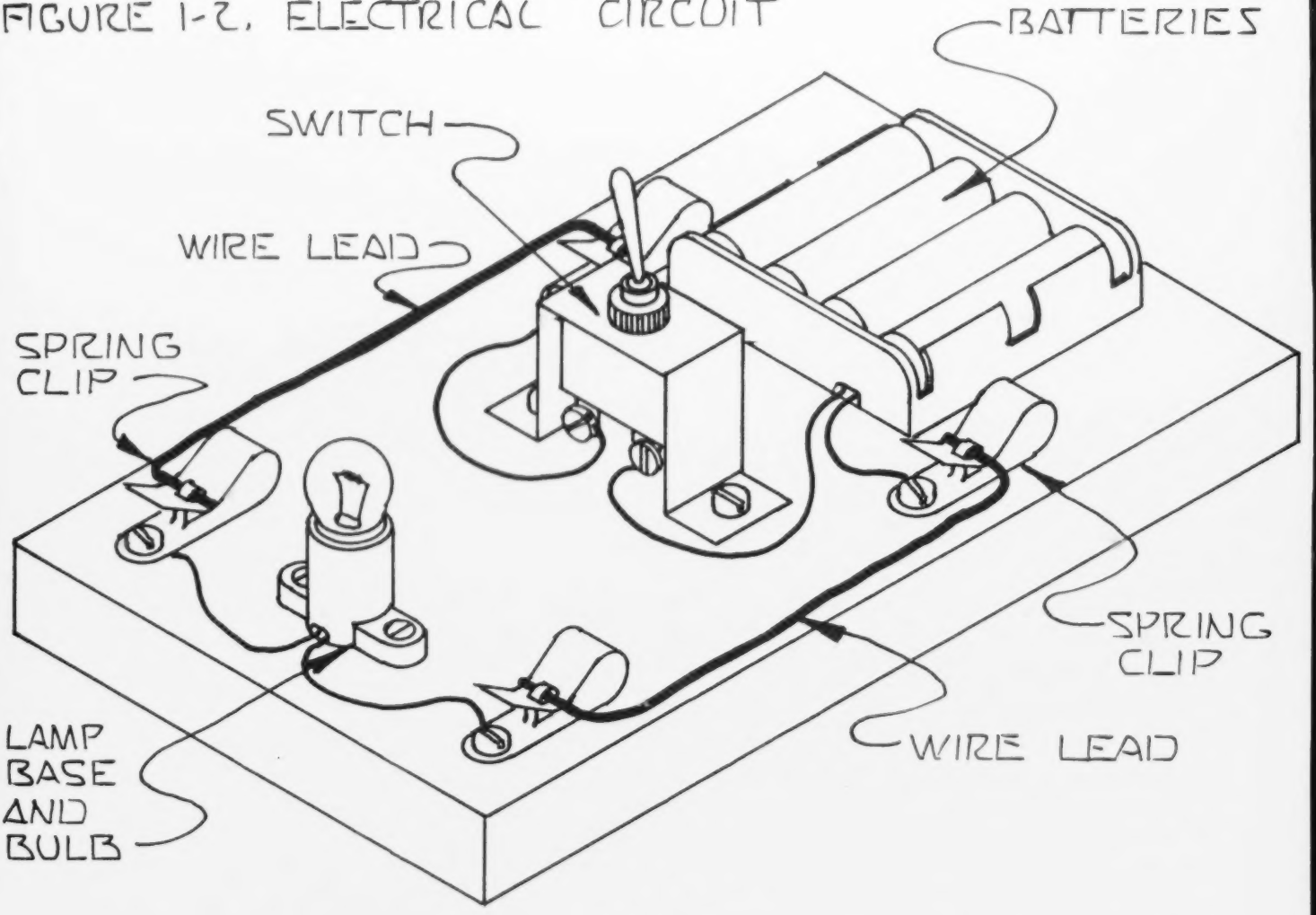


FIGURE 1-2. ELECTRICAL CIRCUIT



OT #1-1

INTRODUCTION TO SERVICE:

* doing work for the benefit of others is called service.

* 68% of all workers are employed in service jobs.

OT #1-2

BASIC TYPES OF SERVICE:

* Industrial Service
  - Work that maintains or improves goods

* Personal Service
  - Work that maintains or improves the well-being of people

OT #1-3

Reasons for the growth in the number of service occupations:

* higher incomes and increased standard of living
* shortage of raw materials and energy
* people own more goods requiring service
* service activities are difficult to automate

OT #1-4

INDUSTRIAL SERVICE ELEMENTS:

* install
* maintain
* repair

OT #1-5

INDUSTRIAL SERVICE PROCESSES:

* diagnose
* adjust
* replace
* modify
* salvage

OT #1-6

Basic types of industrial organizations:

* service companies

* goods producing companies

OT #1-7

ATTRIBUTES OF SERVICE:

* service work is done close to the consumer
* service workers do not produce a product
* service can not be stored for future use
* the service customer pays mostly for labor
* most service companies are small

SERVICING PRODUCTS

Discussion:

Doing work for the benefit of others is called service. Most of the time, service is performed in exchange for payment. Service is so important in today's society that sixty-eight percent (68%) of all workers are employed in service jobs. Two out of every three workers are employed in service jobs and only one out of three workers is employed in goods producing jobs. Service will continue to be important. Jobs in the service industries will increase faster than jobs in the goods producing industries.

There are four reasons why service jobs will increase in importance. First, raw materials and energy are becoming scarce. As a result, the price of new goods will increase. It will be cheaper to maintain and repair old goods than to buy new ones. People will spend more money on repair and maintenance and buy fewer new items. We can no longer throw away broken and worn out goods. We must place more emphasis upon repair and maintenance.

The second reason why service will be more important is due to rising incomes. People will have more money to spend on health care, leisure and school. These are services that will increase as people earn more money. Therefore, as people have more money to spend, they are likely to spend it on services.

The third reason why service will be more important is due to an improved standard of living. This refers to the amount of money people will spend on durable goods and leisure. People will buy more durable goods such as bicycles and television sets. Services will be needed to get these items to the consumer and also to repair and maintain them. Also most leisure time activities require service workers to repair, maintain and manage the goods and property used in leisure activities. Therefore, as the standard of living increases so will the need for services.

Service is difficult to automate. This is the fourth reason why service will be important. Some services such as the automatic car wash or a candy vending machine are services that have been automated. Many services have not been automated. In contrast, many manufacturing jobs have been automated and people have been replaced by machines. This has not been the case with many service jobs. Therefore, the need for service jobs will most likely increase in the future.

Types of Service:

Service may be of two types: industrial service and personal service. Industrial service is the work that maintains or improves goods. Personal service is the work that maintains or improves the well-being of people. Industrial service, therefore, maintains products while personal service applies to people. Examples of personal services may be in such areas as health care, public transportation, recreation, banking and insurance. Such areas as bicycle repair, auto mechanics, building upkeep, appliance installation and airplane mechanics are good examples of industrial services.

Industrial Service:

Industrial service is work that maintains or improves goods. This is done by installing, maintaining, and repairing.

Installing:

Installing is a service only when it is part of the post production activity. A water heater for example, is manufactured in a factory. After it is made, a plumber performs a post production activity that is called installing. Installing is only a service activity when a completed good is fixed into place and hooked up for original use. Installing should not be confused with replacing. If a part is taken out and a new or different part is put in in its place, replacing occurs, not installing.

Maintaining:

Maintaining is the second industrial service element. This may be done to maintain or improve performance, prevent excess wear or to improve the looks of a good. A car engine, for example, may be tuned up in order to increase the gas mileage. The same car may be maintained by changing the oil. The fresh oil will lubricate the parts of the engine to prevent excess wear. The car may also be waxed so that it looks better. These are all examples of service that maintains goods.

Property such as a building or land may also be serviced to maintain it, improve performance, prevent excessive wear or to improve the looks. Painting a building, mowing a lawn and washing windows are all examples of maintaining.

Repairing:

You are probably most familiar with the repairing of goods. Items get broken and parts wear out. As a result, they need to be serviced. Therefore, when goods are broken or they do not work right, they are in need of repair. A pop or candy machine, for example, may not work right. As a result, you might put money in and not get the pop or candy you paid for. The industrial service element of repair is needed.

How Industrial Service is Performed:

You learned earlier that industrial service involves the elements of install, maintain and repair. This is done by one or more of the five service processes of: diagnose, adjust, replace, modify, and salvage.

Diagnosis:

The first and last step to industrial service is diagnosis. When a good is to be serviced by installing, maintaining or repairing, the worker must first determine what is to be done. Many industrial service workers believe that figuring out the problem is half the work. The last step to industrial service is also diagnosis. This is when the worker inspects the good to determine that the work was done correctly. At times, a service worker can diagnose a problem very easily. Other times this is more difficult. The worker will often study a repair manual or diagram (drawing) of the product. A service worker will often use the scientific method of problem solving when diagnosing a problem. The five steps to problem solving are:

* define the problem
* gather information
* form a hypothesis (best guess)
* test the hypothesis
* select and evaluate a solution

Diagnosis by the scientific method of problem solving can save much time and effort. Also, customers get very upset when they pay good money for service and find out that the good is still in need of service. Another benefit of proper diagnosis before industrial service begins is that the customer can be told what the cost will be for parts and labor. The worker will also know how much time is needed for each job and what tools, materials and parts are needed. It is important to remember that diagnosis is the first and last process of industrial service. Diagnosis is done to

determine what must be done. Diagnosis is also done to determine if the work was done properly. A service worker must often make decisions about installing, repairing, maintaining and discarding of goods. A service worker who makes the right decision by using the industrial service process of diagnosis will be in high demand by employers and customers.

Adjust:

Often goods or property are in need of adjustments. The industrial service worker must change or move parts so the item performs like it is supposed to. Gapping spark plugs or setting a door stop are examples of adjustments to goods. Sometimes adjustments may be made when new parts are installed or maintained. Adjustments are also made to repair an item that is not working properly.

Often a part will be ruined or wear out because it was not adjusted properly. As you can see, adjustment is a very important service function to install, maintain and repair goods.

Replace:

We have all experienced times when parts were lost, worn out or broken. The good or property can be serviced by replacing the old part with a new, used or modified one. Replacing of parts is most often done when goods are repaired. Goods are also replaced when maintenance is performed. Changing oil in a car, for example, is a maintenance service in which the old oil is replaced with new oil. Replacement is not often thought of when installation service is performed. There are, however, times when goods or property are replaced as a result of installation. For example, when an air conditioner is installed, the existing electrical service may be replaced to meet the added electrical needs. Also, a door, roof or window may be removed so a large machine can be brought in a building to be installed. In this case, the door, roof or window must be replaced as a result of the installation of a machine.

Modify:

When goods are installed, maintained or repaired, parts are changed to improve or add value to them. A good is modified when small or partial changes are made. In construction, we refer to modifying as remodeling. In manufacturing, modifying is sometimes called rebuilding. Modifying will become more important in the future as inflation continues and raw materials become scarce.

Salvage:

When goods are saved from a complete loss, they are salvaged. Perhaps you are familiar with an automobile junk yard. Cars are cut up and stored until they are sold for scrap metal or replacement parts. The term "recycle" has become popular as a word that refers to salvage. This is also growing as an important service because of scarce raw materials and as a way to clean up our environment.

Service Organizations:

Some day, you might have to deal with a service company as a customer or as an employee. Perhaps you might even own your own service company. You should know more about how and why service companies operate.

Services are offered to the customer for many different reasons. A manufacturing or construction company, for example, may provide a service to promote the sales of their product. "We service what we sell" is a good marketing slogan. These companies provide a service in the form of a guarantee. They guarantee that their product will be of high quality and will be dependable. This type of service is offered to keep the product working properly and the customer happy. The satisfied customers will usually do repeat business and tell their friends about the company. These companies provide the service as part of marketing.

Other companies are in business to provide a service. They hope to make a profit by providing a service for the customer. Many service companies are small in size. In your town, there are many small businesses that provide only a service. Can you name some of the small service companies? Other service companies are very large. The telephone company is an example of a large company that provides a service. Most manufacturing companies require lots of capital (land, money and machines) to produce a product. These goods producing companies have many levels of managers.

In contrast, many service companies are small and do not have as many levels of managers. There are many exceptions to this, one such exception is the telephone company. Since most goods producing companies are large and most service companies are small, the difference is worth noting. You could start a service company with very little capital. Lawn mowing, small engine repair and a gas station are examples of small business companies that provide a service. Would you like to own your own service company? It is important to remember that a service company, large or small, must involve all the elements of a goods producing company.

Attributes of Service:

Operating a service company or service division within a company involves many of the same tasks as operating a goods producing company. Accurate records, for example, must be kept and money must be available to pay bills. Providing a service is similar to producing a good. There are, however, five attributes that are unique to service.

1. Service work is done close to the customer.

   First and most important, a service is often performed close to the consumer. A service worker often goes to the customer's home or business to perform the work. Can you imagine taking a refrigerator to a store for repair? Part of the service in fixing a refrigerator is traveling to the customer. The travel time to and from the customer is part of the service charge. Some things are small enough, or are mobile and can be transported to a central location for service. A toaster or car are examples of this. Even then the service worker often comes in contact with the customer. In comparison, people seldom come in contact with the workers while they make a car or build a building. Think about other appliances or items that cannot be brought in for service.

2. Service workers do not produce a product.

   Service workers do not make a product. They may install, maintain, repair or discard a good or they may perform work that benefits people, but this work does not result in producing a product. In contrast, a goods producing worker makes a product.

3. A service can not be stored for future use.

   A good can be produced and then stored (inventoried) until it is needed. A service can not be stored. A tire, for example, can be changed before it goes flat, but changing a tire can not be stored until the time it is needed. If your furnace does not work, you can not go to a shelf and get the stored repair for it. Even with a good preventive maintenance program, repairs will still be needed. A worker can not do maintenance work ahead of the time that it is needed. Therefore, the industrial service elements of install, maintain, and repair can not be performed and stored before they are needed. Service is consumed as it is produced. This causes scheduling problems unique to service. Workers are often paid to stand by in case a service is needed. Other times, when a service is in high demand, the customer must wait a long time for service.

4. The customer often pays mostly for labor.

When a service is performed, the customer pays for the skill, knowledge and time required to perform the task. Often the customer pays for parts or supplies needed to perform the service, but most of what the customer pays for is labor. When a good is bought, you pay for the raw materials, labor and expensive machines used to make it. Some services are being automated, but most services still involve more labor cost than materials and machines. Therefore, when a service is performed, the customer most often pays mostly for labor.

5. Most service companies are small.

Most service companies are small. They employ a few workers and do not require large buildings such as factories. Some services, such as the utilities and government, are exceptions to this. They are very large and complex organizations. Most service companies, however, are very small when compared to manufacturing companies. There are many small service companies and very few large ones.

Bundle of Benefits:

We learned earlier that there are two types of industries: 1) those that make goods, and 2) those that provide a service. Today most goods producing industries are also involved in performing a service. John Deere and IBM, for example, both produce goods. But they also employ many service workers to maintain the machines and buildings used to produce the product. They also employ many other workers to perform the service for the customer after the product has been sold. Most goods producing companies, therefore, produce a good as well as provide a service. These companies provide a bundle of benefits that include producing a good, as well as providing a service. In fact, almost all purchases you make include paying for a good as well as a service.

Service is an important part of our society. More than 68% of the nation's workers are employed in service jobs. Reasons for growth in the number of service occupations include scarce raw materials and energy, raising incomes, improved standard of living, and difficulty in automating service jobs. The two basic types of service are industrial service and personal service. Industrial service involves work that maintains or improves goods. Personal service is work that maintains or improves the well being of people. The three basic elements of industrial service are installing, maintaining, and repairing. The five industrial servicing processes are diagnosing, adjusting, replacing, modifying, and salvaging.

Learning Activities:

Service is an important part of everyday life. As a consumer, service is an important consideration when buying products like bicycles, stereos, and computers. As a worker, chances are you will be employed in a service job at some point during your career. During the following lab activity, you will experience diagnosing and repairing a defective product.

SERVICING AN ELECTRICAL CIRCUIT

The Problem:

You are a service technician at Acme Sign Company. Your company manufactures and services battery powered signs. When a defective sign is brought to your service center, the electrical circuit is removed and given to a service technician to diagnose and repair. Follow the steps listed below to service your assigned electrical circuit. When you have finished, complete the work order and ask the service manager (your teacher) to approve your work.

Diagnosing and Repairing a Defective Product:

1. Measure the voltage across the batteries using a volt meter. Trace the positive battery wire to the switch. Touch the positive test lead to the positive terminal on the switch. Trace the negative battery wire to a spring clip. Touch the negative test lead to the spring clip. Read the meter and record the voltage in the space provided.

   _____ volts

   If the voltage measured is less than five volts, proceed to step two. If the voltage is greater than five volts, proceed to step three.

2. Remove the batteries from their holder. Measure the voltage across each battery. Touch the positive test lead to the positive terminal while touching the negative test lead to the negative terminal. Record the voltage measured across each battery in the blanks provided.

   Battery One _____ volts

   Battery Two _____ volts

   Battery Three _____ volts

   Battery Four _____ volts

   A good battery will measure about 1.5 volts and a bad battery will measure less than one volt. Identify and replace the bad batteries. Reinstall the batteries in their holder. After the batteries have been installed, move the switch to its on position. If the light lights, proceed to the section on completing the work order. If the light does not light, proceed to step three.

3. Remove the light bulb from its lamp holder. Test the light bulb by screwing it into the lamp holder on the test panel. If the light bulb lights, screw it back into its original lamp holder on the product, and proceed to step four. If the light bulb does not light, install a new light bulb in the lamp holder on the product. After a new bulb has been installed, turn the switch to its on position. If the light bulb lights, proceed to the section on completing the work order. If the light bulb does not light, proceed to step four.

4. Test the switch with the continuity tester. With the switch in the off position, touch one test lead to the positive terminal, and touch the other test lead to the negative terminal. Turn the switch on. The light bulb on the continuity tester should light. If the light bulb does light, proceed to step five. If the light bulb does not light, replace the switch. After the new switch has been installed, move it to its on position. If the light bulb lights, proceed to the section on completing the work order. If the light bulb does not light, proceed to step five.

5. Using the continuity tester, check the wire leads. Connect the test leads to the clips at each end of a wire lead. If the light bulb on the continuity tester lights, the wire lead is good. If the light bulb does not light, remove and replace the wire lead. When both wire leads have been tested, move the switch to its on position. If the light bulb lights, proceed to the section on completing the work order. If the light bulb does not light, you have made a mistake somewhere along the servicing process. Return to step one and start over again.

Completing the Work Order:

The work order describes the service for which the customer will pay. It lists the names of the service technicians, describes the service performed, and lists all parts and labor costs.

1. Begin completing your work order by writing your names in the blanks provided under "service technicians."

2. Next, identify the parts you checked and replaced by putting a checkmark in the blank next to each part (see example work order).

ACME SERVICING

Work Order

Service Technicians:

JIM JONES

JOHN BROWN

MARY SMITH

The Problem:

THE LIGHT WILL NOT LIGHT

	SERVICE		COSTS	
	Checked	Replaced	Labor	Parts
Battery 1	✓		1.00	
Battery 2	✓		1.00	
Battery 3	✓		1.00	
Battery 4	✓		1.00	
Light Bulb	✓	✓	2.00	.80
Switch				
Wire Lead 1				
Wire Lead 2				

LABOR	6.00
PARTS	.80
TOTAL	6.80

ACME SERVICING

Work Order

Service Technicians:

_____

_____

_____

The Problem:

_____

_____

	SERVICE		COSTS	
	Checked	Replaced	Labor	Parts
Battery 1	_____	_____	_____	_____
Battery 2	_____	_____	_____	_____
Battery 3	_____	_____	_____	_____
Battery 4	_____	_____	_____	_____
Light Bulb	_____	_____	_____	_____
Switch	_____	_____	_____	_____
Wire Lead 1	_____	_____	_____	_____
Wire Lead 2	_____	_____	_____	_____

LABOR _____

PARTS _____

TOTAL _____

SERVICING SMALL ENGINES

The Problem:

You are a service technician at Jimmy Bob's Engine Service. Your company services small engines. When a defective engine is brought to your service center, it is taken off the lawn mower and given to you to service. Follow the steps below to diagnose and repair your assigned engine. When you have finished, have the service manager (your teacher) check your work before you test the engine. Once the engine is working properly, complete the work order.

Diagnosing and Repairing a Defective Engine:

1. The first step when servicing a small engine is to check the ignition system. Begin by carefully disconnecting the spark plug wire. Using a spark plug socket and a socket wrench, carefully remove the spark plug. To remove the spark plug, you will need to rotate the socket wrench counterclockwise. After you have removed the spark plug, reconnect the spark plug wire. Using a wooden spark plug holder, hold the base of the spark plug against the top of the cylinder head. Pull the starter cord and watch for a spark between the electrodes. If you observed a spark, proceed to step two.

   If you did not see a spark jump between the electrodes, replace the spark plug. Repeat the ignition check with the new spark plug. If you observe a spark jump between the electrodes on the new spark plug, proceed to step two. If you do not observe a spark jump across the electrodes, ask the service manager (your teacher) for assistance.

2. Disconnect the spark plug wire from the working spark plug. Put the spark plug in a location where it will not be damaged. Carefully insulate the terminal at the end of the spark plug wire with electrical tape. Place your thumb over the top of the spark plug hole. Make sure you apply enough pressure to create a tight seal. Pull the starter cord.

   If you feel compressed air against your thumb, proceed to step three. If you do not feel compressed air, use the correct size socket and socket wrench to remove the bolts securing the cylinder head. After the bolts have been removed, carefully lift the cylinder head off the engine block. Inspect the head gasket. If it is damaged, replace it with a new gasket. If you cannot

find any defects, ask the service manager (your teacher) for assistance.

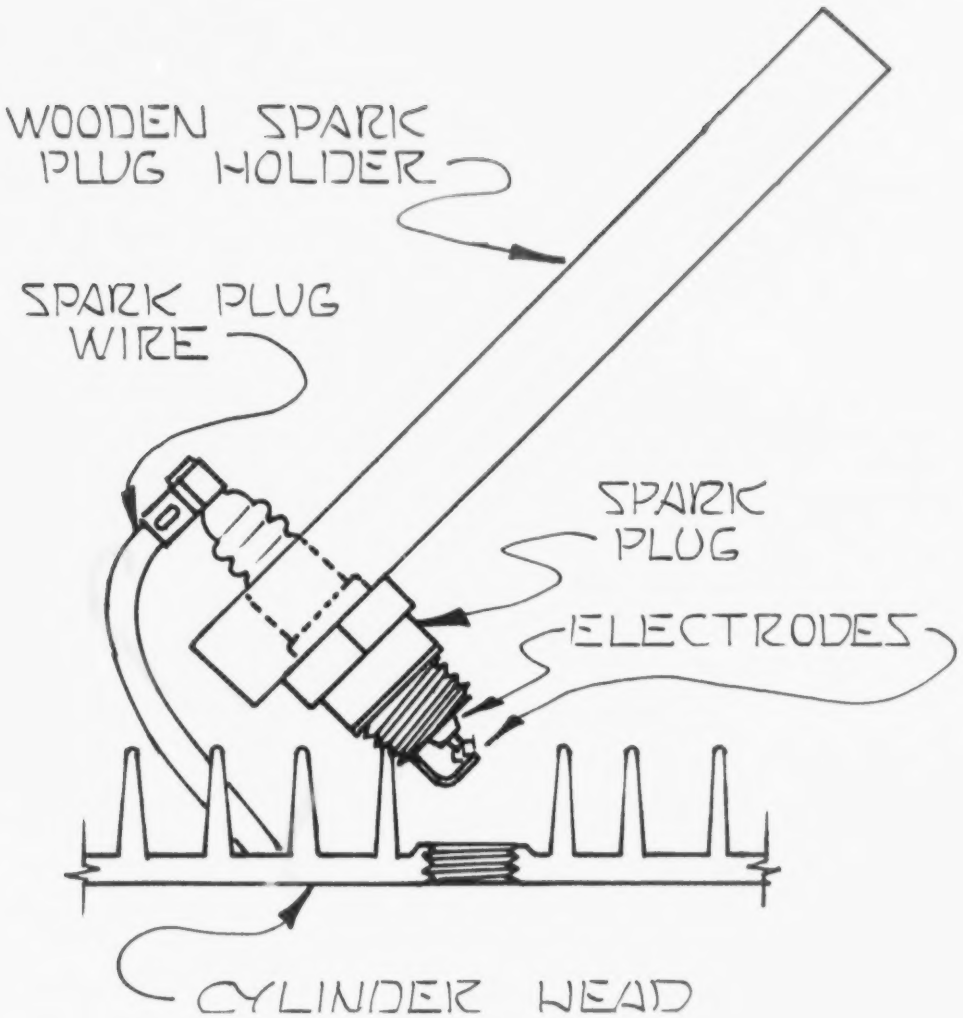
Position the new head gasket on top of the engine block so all the holes line up. Carefully put the cylinder head on top of the gasket and engine block. Reinstall the head bolts and make sure you tighten them in the order your teacher demonstrated. Do not overtighten the cylinder head bolts. Repeat the compression test with your thumb. If you feel compressed air againts your thumb, proceed to step three. If you still do not feel compressed air, ask the service manager (your teacher) for assistance.

3. With the spark plug still removed, check the fuel system. Place your thumb over the spark plug hole. Again apply enough pressure to create a tight seal. Pull the starter cord. Remove the thumb, hold it to your nose, and give it a sniff. If you smell gas, proceed to step four.

   If you do not smell gas, check the idle fuel screw and/or main fuel screw. Using a screw driver, you should be able to turn both screws one quarter turn in either direction. If the screws will not turn clockwise, adjust them counterclockwise according to your teacher's instructions. After the adjustments have been made, proceed to step four.

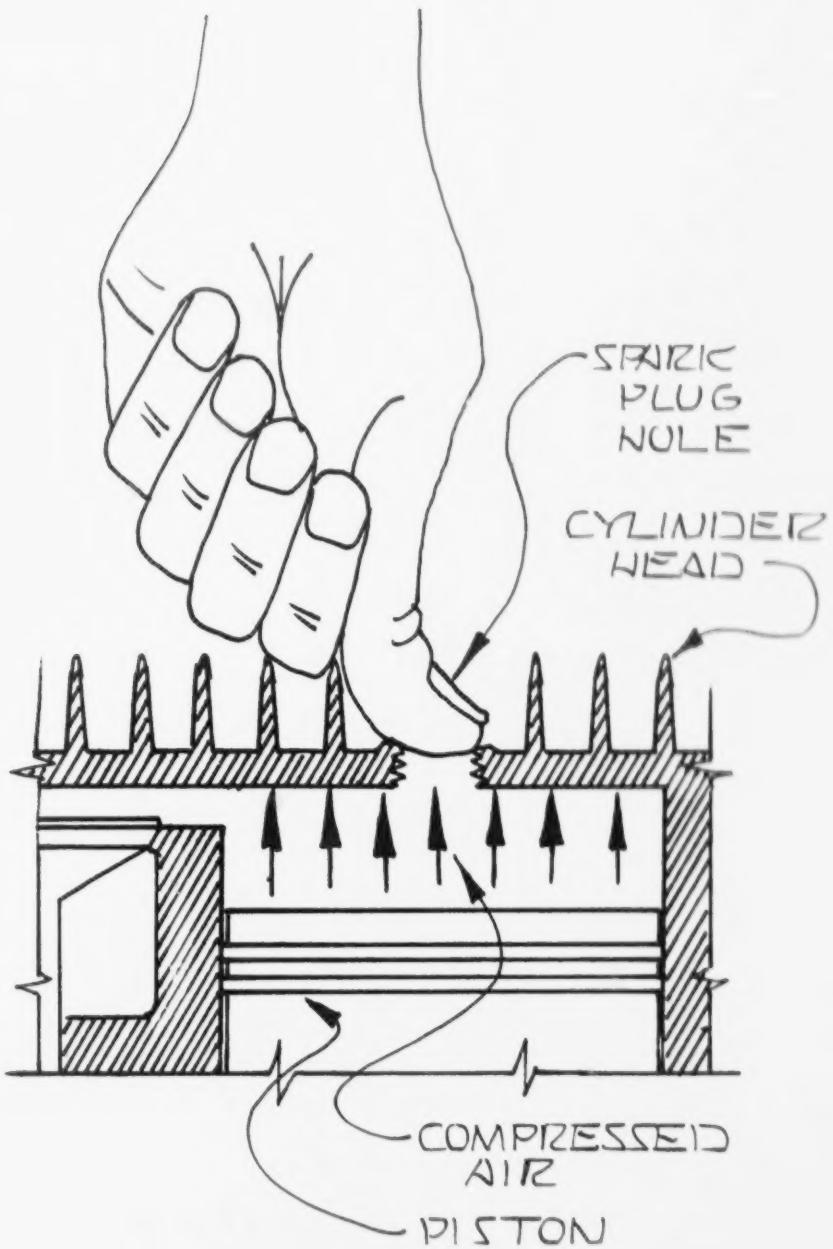
4. Install the good spark plug by hand. Twist it counterclockwise until it is snug. Using a spark plug socket and socket wrench, tighten the spark plug according to your teacher's instructions. Do not overtighten the spark plug. Carefully remove the electrical tape insulating the terminal at the end of the spark plug wire. Reconnect the spark plug wire to the spark plug.

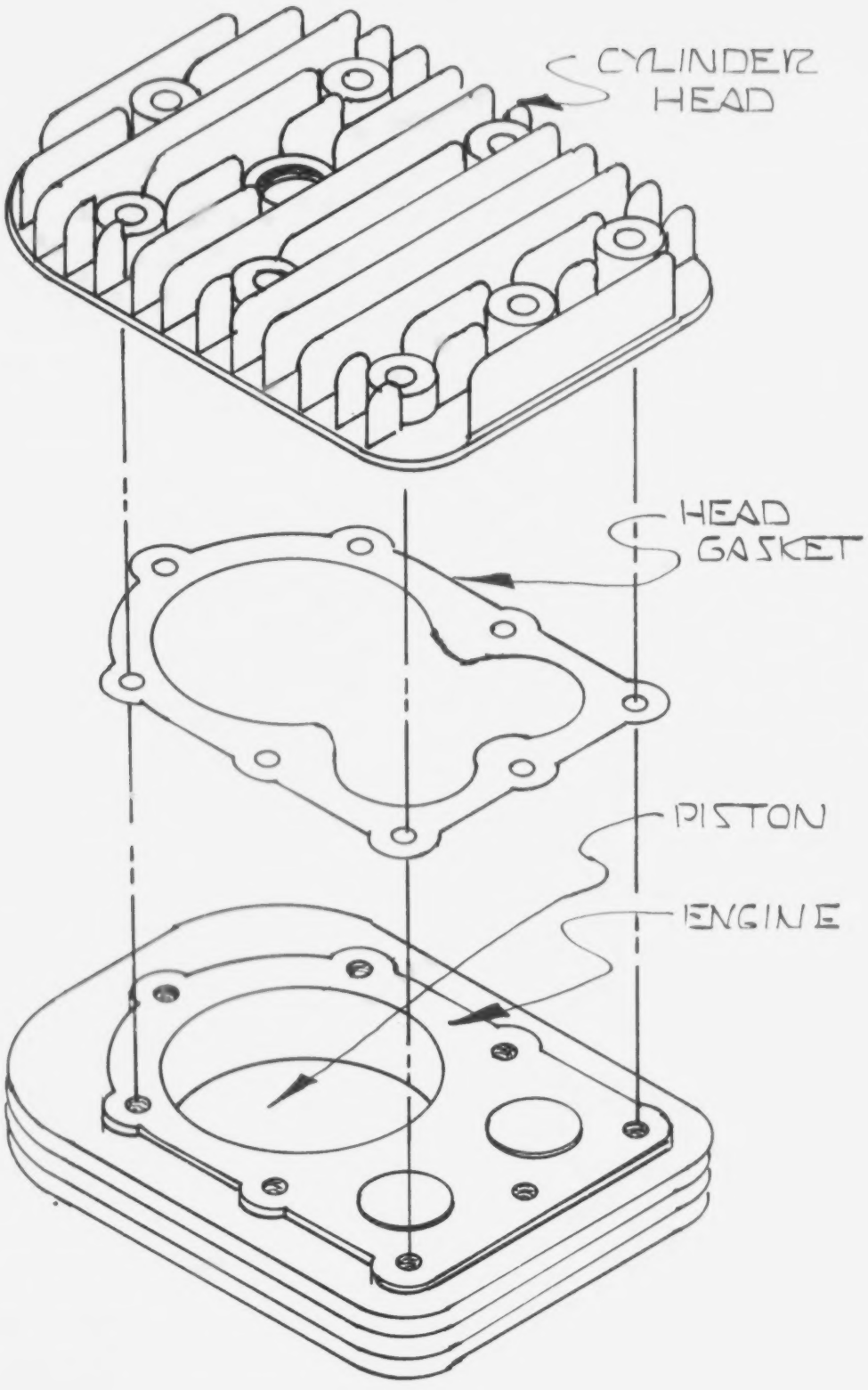
5. Ask the service manager to approve your repairs. List the test you performed, the parts you replaced, and the adjustments you made. After your work has been completed, move your engine to the test area according to your service manager's (your teacher's) instructions. Check the oil level to make sure it is safe to start the engine. After you have made a final inspection, start the engine. Make sure you follow all the safety rules for operating an engine. Make whatever final adjustments are necessary. Once your engine has been tested and is working properly, proceed to the section on completing the work order.



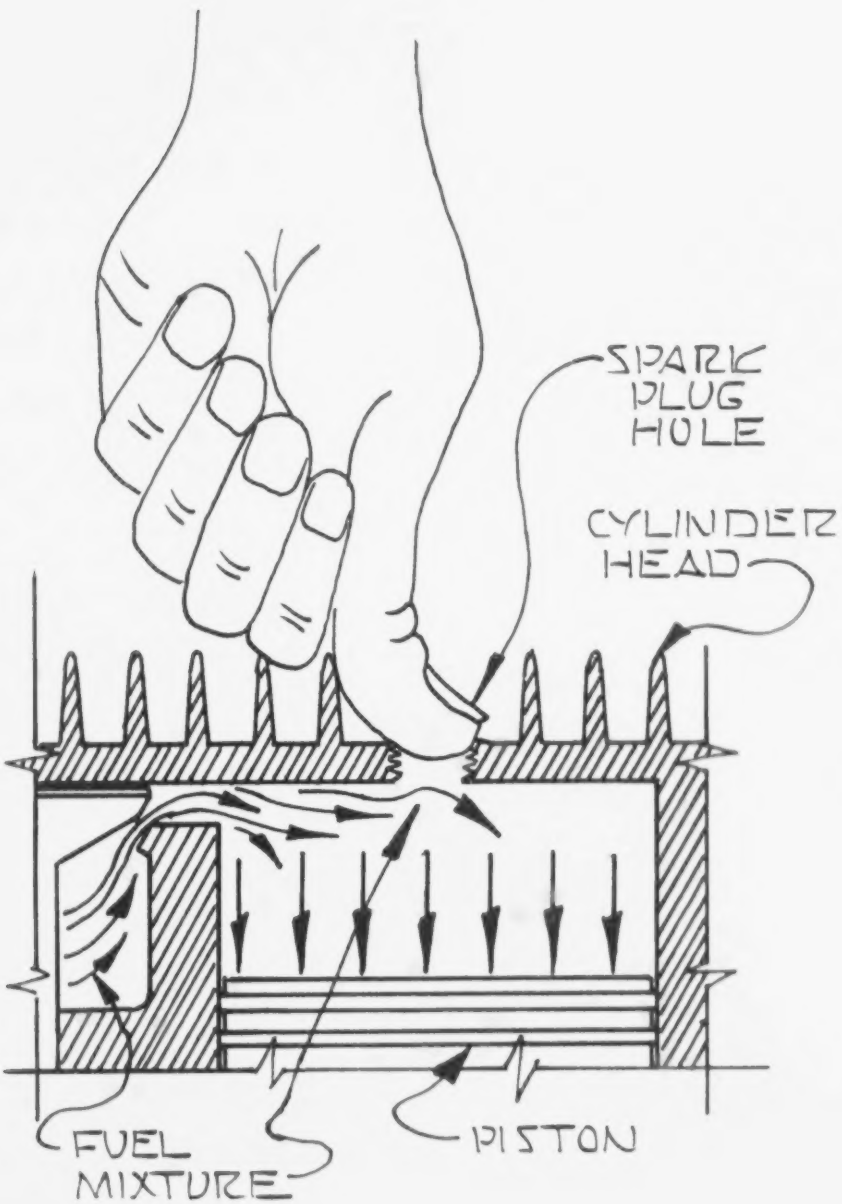
TESTING THE IGNITION SYSTEM

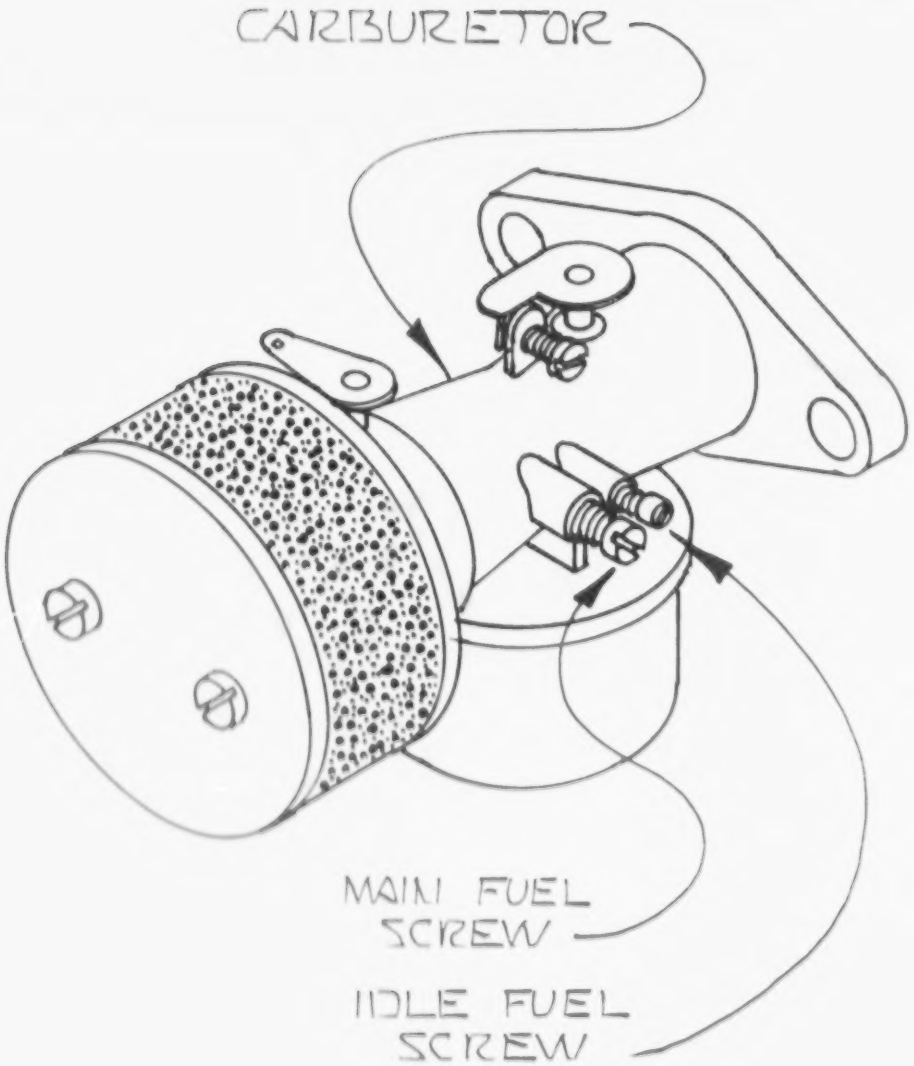
TESTING THE COMPRESSION SYSTEM




CYLINDER HEAD
HEAD GASKET
PISTON
ENGINE

TESTING THE FUEL SYSTEM




CARBURETOR
MAIN FUEL SCREW
IDLE FUEL SCREW

Completing the Work Order:

The work order describes the service for which the customer will pay. It lists the names of the service technicians, describes the service performed, and lists all the parts and labor costs.

1. Begin completing your work order by writing your names in the blanks provided under "Service Technicians."

2. List the labor cost for each system checked and each part replaced. Enter $1.00 in the Labor column for each system checked. Enter $2.00 in the Labor column for each part replaced (see the example work order).

3. List the cost of each part replaced in the Parts column. Refer to the list below for the cost of each part.

Spark Plug	$1.00
Head Gasket	2.00

4. Add all the Labor costs together and enter the total in the blank next to Labor.

5. Add all the Parts costs together, and enter the total in the blank next to parts.

6. Add the total cost of Labor to the total cost of Parts and enter the total in the blank next to total.

7. Give both the repaired product and the completed work order to the service manager (your teacher).

3. List all the labor costs in the labor column. Enter a $1.00 labor cost for every part you checked. Enter a $2.00 labor cost for every part you replaced.

4. List the cost of each part replaced in the parts column. Refer to the list below for the cost of each part.

Batteries	$ .40
Bulbs	.80
Switches	1.25
Wire leads	.25

5. Add all the labor costs together and enter the total in the blank next to labor.

6. Add all the parts costs together and enter the total in the blank next to parts.

7. Add the total cost of labor to the total cost of parts and enter the total in the blank next to total.

8 Give both the repaired product and the completed work order to the service manager (your teacher).

JIMMY BOB'S ENGINE SERVICE

Work Order

Service Technicians:

JOHN SMITH

MARY JONES

JIM BROWN

The Problem:

THE ENGINE WILL NOT START

LABOR	COST	PARTS	COST
Checked ignition system	2.00	Spark Plug	1.00
Checked Compression system	1.00	Head Gasket	
Checked fuel/air system	1.00		
Adjusted fuel/air system			

LABOR	4.00
PARTS	1.00
TOTAL	5.00

JIMMY BOB'S ENGINE SERVICE

Work Order

Service Technicians:

_____

_____

_____

The Problem:

_____

_____

LABOR	COST	PARTS	COST
Checked ignition system	_____	Spark Plug	_____
Checked Compression system	_____	Head Gasket	_____
Checked fuel/air system	_____		
Adjusted fuel/air system	_____		

LABOR _____

PARTS _____

TOTAL _____

Unit: Servicing Products

Lesson 2: Evaluation

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to complete given concept statements regarding servicing products with a minimum of 70% accuracy.	A. Review 1. Definitions a. service b. industrial service c. personal service 2. Importance of service 3. Elements of industrial service 4. Industrial service processes 5. Attributes of service	A. Teacher Guided Review 1. Review the major concepts explored in this unit. 2. Provide students with an opportunity to ask questions before taking the test. 3. Provide students with HO #2-1. Make sure each student has a pen or pencil. 4. Explain the directions for the test. 5. Have students read the test and answer the questions provided. 6. Collect the test and grade your students' performance. 7. Provide the students feedback regarding their test performance as soon as possible.	

SERVICING PRODUCTS

Unit Test

Directions: Read each statement carefully. Circle the letter of the answer you think best answers the question.

1. Industrial service is _____.

   A. building new structures
   B. manufacturing new products
   C. improving the well-being of people
   D. maintaining or improving goods

2. Personal service is _____.

   A. transporting products from one place to another
   B. remodeling existing structures
   C. maintaining or improving the well-being of people
   D. repairing manufactured and constructed products

3. Over _____% of all workers in the United States are employed in a service occupation.

   A. 21
   B. 42
   C. 52
   D. 68

4. Which of the following is a reason why service will continue to be important in the future?

   A. the work force is getting older
   B. service is difficult to automate
   C. products will wear out faster
   D. products are harder to repair

5. Which of the following is an example of a goods producing occupation?

   A. auto mechanic
   B. doctor
   C. production welder
   D. truck driver

6. Which of the following is an example of a service occupation?

A. carpenter
B. appliance repair person
C. factory worker
D. farmer

7. Which of the following is an example of an industrial service occupation?

A. auto mechanic
B. hair stylist
C. assembly line worker
D. lawyer

8. Companies that manufacture things like copy machines, automobiles, and computer systems are interested in _____.

A. providing industrial service
B. providing personal service
C. producing a product
D. producing a product and providing an industrial service

9. Fixing a bicycle is an example of _____.

A. industrial service
B. personal service
C. producing a product
D. producing and servicing a product

10. Putting a burglar alarm in a new car is an example of _____.

A. installing
B. maintaining
C. repairing
D. salvaging

11. Setting the idle on a lawn mower engine is an example of _____.

A. diagnosing
B. adjusting
C. replacing
D. modifying

12. Fixing a flat tire on a bicycle is an example of _____.

A. installing
B. maintaining
C. diagnosing
D. repairing

13. Changing the oil on an automobile is an example of _____.

A. salvaging
B. modifying
C. maintaining
D. repairing

14. Removing a burned out bulb and installing a new one is an example of _____.

A. diagnosing
B. replacing
C. adjusting
D. modifying

15. Remodeling a kitchen is an example of _____.

A. maintaining
B. modifying
C. repairing
D. salvaging

16. Which of the following is typical of a service industry?

A. A product is produced.
B. The work is performed in a factory.
C. The customer pays primarily for labor.
D. Most companies are large.

17. Which of the following is typical of a manufacturing industry?

A. The work is performed close to the customer.
B. Most companies are small.
C. The customer pays primarily for labor.
D. The process is highly automated.

References

Bohn, R. C., MacDonald, A. J., Fales, J., & Kuetemeyer, V. F. (1986). Energy, power, and transportation technology. Encino, CA: Glencoe Publishing Co.

Ginzberg, E., & Vojta, G. J. (1981). The service sector of the U.S. economy. Scientific American, 244(3), 48-55.

Henak, R. M. (1985). Exploring construction. South Holland, IL: The Goodheart-Willcox Company, Inc.

Squire, T. J. (1985) Servicing the manufactured good. In K. N. Starkweather (Editor-in-Chief), The Technology Teacher (pp. 13.14). Reston, VA: International Technology Education Association.

Umstattd, W. D. (1979). Product servicing curriculum: a rationale and structure. Journal of Industrial Teacher Education, 16(3), 12-20.

Wright, R. T. (1985). Exploring Manufacturing. South Holland, IL: The Goodheart-Willcox Company, Inc.